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ments of weights lifted with one hand by lifting heavy weights with the other.

This illusion is due, not to "contrast," but to an unconscious adaptation (*Einstellung*) of the motor centers to the more vigorous impulses required by the heavier weights. In the normal comparison of weights the nervous discharge for the lifting of each, though wholly unknown in amount to the subject, is the same. *The judgment is made from the speed with which the weight comes up.* When by the change of weights a discharge adapted to a heavy one meets a light one, the latter rises with an unaccustomed velocity and is therefore pronounced lighter. Such motor adaptations may be of different kinds, and, corresponding to them, there is an adaptation of the sensory attention. Such adaptations play a part in ataxic phenomena: (*e. g.* a patient unable to move a given finger at request except with open eyes, once having developed a motor adjustment by moving it so, can thereby keep on moving it for a little while after his eyes are closed), in the pleasure of rhythmic movements, the periodicity of the time sense, etc. The authors reject the inner-ervation sense *in toto*, (in a later chapter they subject it to a thorough-going critique), likewise the muscle-sense, at least as a factor in judging weights. If such senses are the discriminating ones, they should tell us of the amount of force expended and prevent the illusion. The theory that weights are judged by the velocity with which they are lifted was suggested by Hering in a letter to Fechner, and was adumbrated by Lewinski and others, but has now for the first time been given a full experimental treatment. If weights are judged by velocity, the question of the perception of the movements and positions of the limbs becomes a cardinal one. On this point the authors accept the views of Goldscheider, locating the sensations chiefly in the joints, but reject his notion of an independent motion-sense.

Other sources of error were investigated, *e. g.* the *Zeitfehler*, or error introduced by the order of lifting the weights and the time interval between the lifting of the standard and of the weight to be compared, and the *Raumfehler*, or error introduced by the different distance and direction of the weights from the body of the lifter. Both of these find interesting and plausible explanation in the adaptation theory stated above. Special fatigue experiments showed, contrary to Fechner's "parallel law," a decline in the discriminative sensibility. A third weight lifted between the two to be compared, at first caused large errors, but the subject soon became able to neglect it. Weber's law follows as a necessary consequence of this theory, provided that light and heavy weights are judged by their velocities, for the just observable difference is then a difference of velocities, and it is a principle of mechanics that the change in mass needed to produce a fixed (just observable) change in the rate of a moving mass must vary proportionally to that mass. Practically however the law is much overlaid by confusing circumstances.

*Voluntary Control of the Heart.* EDW. A. PEASE. Reprint from the Boston Med. and Surg. Journal, May 30, 1889.

Mr. Pease reports a set of experiments upon a student in the Harvard Medical School who possesses this rare power. The subject was able with little irregularity of respiration to increase his pulse-rate for a few seconds in the proportion of about 17 beats per

minute, and by holding his breath at the rate of 27 per minute. Other experiments show, however, that the power does not consist in any change in breathing, nor does it depend on increased blood pressure, voluntary motion, nor, according to the subject, on the fixation of any emotion or idea. The change of rate seems to be effected by a series of impulses which gradually weaken in force; the power to produce these is also easily exhausted. The subject, as seems general in such cases has a certain power over the ear muscles and others not commonly under control.

*On the Observation of Sudden Phenomena.* S. P. LANGLEY. Amer. Jour. of Sc. XXXVIII, 93, Aug. 1889.

Reference was made in an earlier number of this JOURNAL (II, 24) to a device of Prof. Langley's for excluding personal equation in transit observations. He now presents a simple and ingenious instrument for practically excluding it in the observation of sudden phenomena (*e. g.* the emergence of stars from the dark limb of the moon, etc.). The detail of the instrument must be seen in the original; but in general it depends on the introduction of a double total-reflection prism, revolving in the axis of the instrument. The image of the emerging star, or whatever the phenomenon be, is thus made to appear in a different sector of the field according to the part of the second in which it occurs. On trial with a field divided into 20 sectors and an artificial star, one of the observers, without special practice, reduced his probable error for a single observation to about one fortieth of a second.

*Ueber die galvanischen Erscheinungen in der Haut des Menschen bei Reizungen der Sinnesorgane und bei verschiedenen Formen der psychischen Thätigkeit.* J. TARCHANOFF. Pfüger's Archiv, Bd. XLVI. pp. 46-55.

These experiments were made with the galvanometer of Meissner and Meyerstein, the deflections of the mirror being read off on a scale by means of a telescope. The instrument was so sensitive that the current in the N. ischiacus of the frog was sufficient to cause the scale to disappear from sight. The electrodes were applied to different parts of the body, principally to the outer surface of the hand and the inner surface at the base of the fingers. The currents of a state of rest were compensated for, and the subject was, of course, undisturbed and motionless. It was found that tickling was sufficient to cause a strong deflection of the needle. After a latent period of from one to three seconds, the current was at first weak and slow, and then so strong as to put the scale out of sight. The inside of the hand was negative, the outside positive. Electricity, heat and cold, the prick of a needle, caused the same effect, but not to such an extent. So did stimulation of the special sense-organs, the sound of an electric bell, the smell of vinegar and ammonia, the taste of sugar, etc. After the eyes had been closed for some time, simply opening them was sufficient to produce a current. Different effects were produced by different colors,—it is not stated what colors were the most irritating. But when no sensation was experienced, the mere imagination of a sensation was sufficient to produce a change of from 10 to 15 divisions on the scale. The idea of extreme heat was especially effective, and still more so if the hand, which was being tested was